Office, in its present economical fit, will spend the money necessary to build a Museum for the proper exhibition of its collections of manufactures and natural history, the following two solutions of the difficulty may be suggested.

(1) That an arrangement be made with the Commissioners of the Exhibition of 1851 to exhibit the collections at South Kensington, either in one of the existing buildings, or in one to be constructed for that purpose. The French have an "Exposition des Produits des Colonies" in part of the former Palais de l'Industrie in the Champs Elysées, and there is no reason why we should not follow so desirable a precedent.

(2) If this cannot be effected, the whole of the collections should be transferred to the trustees of the British Museum. It is, of course, quite certain that the trustees could not exhibit them, looking to the crowded state of their galleries in Great Russell Street. But at all events they would be thus saved from risk of further deterioration, and might be rendered accessible to working naturalists who have occasion to consult them. P. L. S.

UNIVERSITY OARS*

III.

We have stated that in our opinion the evils of boat-racing as now practised are traceable to two causes, 1st to a misconception of the nature of the demands which it makes on the several energies of the body; and 2nd, to the system of preparation, or, as it is technically called, *training*, which is undertaken to enable the body to meet these special demands upon its energies.

In our remarks last week we stated at some length wherein lay the first of these misconceptions, namely, in the nature and extent of the effort made by the muscular system and the respiratory and circulatory system, respectively, showing that while the exertion was slight, if not actually inadequate to the requirements of the former, it was both in amount and character severe, if not absolutely dangerous, in the latter.

The origin of the first misconception, and the reason why it should have lived so long, and should still live, we think may be thus explained. When rowing was first adopted by lads at schools and young men at universities as a regular mode of exercise, and friendly matches of speed and dexterity were organised, the boats used, probably, were not greatly different in size, in shape, or in other points of construction, if in any, from those at the time in use by professional watermen; and the manner of rowing was also, very probably, after the waterman's type. If this were the case then rowing furnished abundant exercise, not only to those portions of the rower's frame which still receive a fair share of employment, but to those also which are at present virtually excluded from the task, or have a very inferior part to play in it; for the heavy, bulky, broad and deep boats, clumsy, unwieldy, and unskilfully arranged oars and rowlocks, would necessitate a slow and protracted stroke, and both upper and lower limbs would have their part to play and their work to do in dragging the oar through the water. Gradually, changes and improvements would be introduced, lessening the labour, heightening the art, until art and labour in boat propulsion attained their present positions and proportions, the former reduced to a minimum, the latter standing eminently high: but just in proportion to the prominence of these conditions are its merits as an exercise in an inverse ratio to be estimated. There was plenty of muscular exertion for the whole frame in lugging along the old-fashioned boats. There was little or no distress to heart or lungs in its protracted stroke and deliberate pace. We frankly confess that there would be little in the old style of boat-racing to create and sustain the enthusiasm at present displayed in these contests; and we are expressing no regret at the changes that have taken place, and no wish to return to their primitive, albeit safe conditions: what we do wish is to let rowing remain as it is, nay, to let it pursue its onward course of change and improvement like all other things, but to see if the old order of safety cannot be retained with these advancements, by obtaining from other sources those properties which recent changes have altogether eliminated or reduced to inefficient proportions.

To glance at the reason why the misconception regarding the actual nature of a boat-race as now rowed, should have so long existed, and should still exist, we think it needs only to be pointed out that only quite recently has any really critical inquiry been instituted on the subject, and when the results of this inquiry were made known, they savoured to the oarsman like the prescribed "nasty medicines" to the child; *i.e.* whatever good they may have been calculated to effect, they were nevertheless unpalatable, and if not actually rejected were at any rate swallowed with dislike. But rowing men are not singular in this respect, in claiming for their favourite exercise, through all its changes, in all its attributes, *perfection*; they are claiming no more than all enthusiastic votaries of a special exercise claim, and many with less excuse and less right to an indulgent hearing than the oarsman. "It gives exercise to every muscle of the body," say they, "No exercise whatever," we reply, "does this." No single exercise gives more than employment to a portion of the body, and to that portion sometimes a very inadequate share.

The errors involved in the second misconception in a great measure originate in the first, and their nature is revealed, and the manner of their connection explained as we proceed in making ourselves acquainted with it. Thus an oarsman at a given time will be called upon to row a race which will tax his bodily energies *such as he knows them, or believes them, to be*, to the uttermost; the effort will be quite exceptional in its severity and he therefore desires to prepare for it, to fortify himself for it, by every means in his power. Now it need hardly be said that if he is ignorant of the nature of the demands which the effort will make upon him, he cannot rightly prepare himself for that effort; nay, he may, and probably will, go wrong, for advice will be pressed upon him at all hands, and here at any rate, "In the multiplicity of counsel there is *not* wisdom." When it is remembered that this preparation or training embraces the administration, or use, of all the material agents which sustain life and give health and strength, it will not be wondered at that mistakes have been made in this direction, and that man should have come to speak of the *ordeal* (*!*) of training as of a trial as great if not greater than the effort itself for which the training was instituted. Thus one of Dr. Morgan's correspondents who rowed bow at Putney in 1849, Rev. D. Wauchop, Wadham College, Oxford, and a friend of our own of long standing, writes: "A curious circumstance with regard to training I would mention, and that is that one of the most sinewy and lasting men of my friends, who had been accustomed to rowing since he was little more than a child, and who was a particularly steady and temperate man, and so good an oar as to be chosen stroke for a time, never could stand training. After a few days of it he invariably broke down, and therefore never rowed in a race."

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* Continued from p 418.

It will therefore be easily seen how great must be the advantages to rowing of clearing up what we have called the *first misconception*, in the light of its effects upon the health of the men engaged in it—the only light which would justify our having entered upon the subject at such length in the columns of a purely scientific journal. Thus while it was imagined that rowing entailed tremendous muscular exertions upon the oarsman, rules as to *diet*, *sleep*, and *exercise* were laid down to meet such exertions, one authority recommending men to be in bed ten or eleven hours; for diet underdone meat in vast quantities, and without vegetables—"not even a potato"—was prescribed, while exercise of any or all kinds put together was cut down to less than one hour in the twenty-four. Thus did the first misconception sustain and prolong the existence of, if it did not give origin to, the second.

The errors in *sleep* and in *diet* are being rapidly cleared away. They are destined soon to be numbered among the vagaries of the past, and in this place we may already pronounce them undeserving of serious exposure or condemnation. With the other agent of health named above, however, as affected by a want of true knowledge of the exertion undergone in rowing, namely, exercise, the case is different. The errors on this head are still many and grave, and to the correction of them we must look before we can expect to see any material improvement in the hygienic value of rowing; it is to exercise we must look to restore the lost equilibrium of rowing on the several systems of the body; to exercise we must look to equalise the partial developments of the frame now caused by rowing as exclusive of muscular exertion; to exercise we must look for that increase in vigour and power and functional capacity generally, now wanted to enable the organs of circulation and evaporation to sustain the extreme effort which they are called upon to fill during a boat-race.

We will assume that we have established that in rowing the chest and upper limbs receive an inadequate share of the exercise, and therefore in accordance with the organic law regulating material development and functional capacity,—that "*these will be in relation to employment*," —an advancement in these respects will be shown in those regions, inferior to what is observable in other parts of the body when the employment is greater. This assumption being admitted, it will also be admitted that any want of development or capacity experienced in these regions—whether in the power of the muscles aiding respiration, in the size or conformation of the thoracic cavity, or in the size, conformation or capacity of the organs which they contain,—would affect, and affect in an increasing ratio with its extent, the respiratory effort during a boat-race.

We admit that we are somewhat at issue with Dr. Morgan, inasmuch as he does not go with us so far as to acknowledge this partial division of the labour, and consequently of the reward to the parts engaged, in the act of rowing; but he *does* acknowledge that if it *did* exist, the right way to its rectification would be to supply to the parts found wanting, employment elsewhere and in other form. This is nearly all that we can desire—perhaps more than at this date we have yet a right to expect from a devoted oarsman, jealous of his craft. His language is emphatic and significant:—

"In examining patients for insurance companies, I have frequently refused the lives of young persons on the ground that their chests were narrow and shallow. In several instances, however, these thoracic defects have been corrected by a systematic course of gymnastic exercises, justifying me at a later period in recommending their acceptance. At no time and in no place could every useful variety of exercise be more advantageously carried out than at Oxford and Cambridge; they might, for the class by which they are frequented, serve as valuable national gymnasia."

Dr. Morgan might have taken a wider base for his congratulations on the establishment of gymnasia than Oxford and Cambridge; the greater number now of our public schools are also so provided, namely, Uppingham, Radley, Cheltenham, Clifton, Marlborough, and Rugby. We place them here in the order in which they have been carried out, Rugby being our last organisation. From all these schools men are coming up to the Universities, after having continuously, during the most important period of their growing time, received a course of carefully systematised bodily training, carried out in buildings specially designed for this purpose, and conducted by teachers duly prepared, and bearing certificates of qualification. All the youths will bring with them not only chests "larger and deeper," with hearts and lungs stronger, ampler, and more vigorous, but the knowledge of what a good strong, or well-formed chest is, how it is got, and how it may be lost; and this with the similar advantages of the Universities, and shared in by University men, will surely in time enable us to overcome the evil of rowing, the danger to rowing men: for the whole question is now narrowed to one point. Give to men who now take rowing as exclusive exercise such other exercise as will develope the parts of the body which rowing but imperfectly employs, namely the chest, and you at once endow with vigour and strength the parts that are dangerously taxed in the boat-race. We have known men standing 5 ft. 9 in., with chests measuring 32 in. only, rowing in their college eights! And men standing over 6 ft. in their stockings, with chests measuring 35 in., rowing in the inter-University race at Putney! To what end can these lead? to what but danger to the men, alarm to their friends, and injury to the name and to the interests of the art to which they affect to be devoted. We repeat here what we uttered years ago—"No man of ordinary stature and fair growth should be allowed to put hand upon an oar in a racing boat until his chest has the minimum girth of 36 in.; less will not give him space adequate to the full and fair action of the vital organs within, in the work upon which he would engage; less no man of ordinary stature and fair growth need pass his eighteenth year without possessing."

In bringing these remarks to a close, we desire heartily to congratulate Dr. Morgan on his book, both in conception and execution, and also to congratulate University oarsmen in having a work of this character dedicated to investigations of the doubtful and disputed points of their favourite exercise. If he has not succeeded in showing that the Putney course is quite free from danger, he has shown that it is not so perilous as it was pronounced to be,—*i.e.* not the *via mala* which it had been named. To the disputants on both sides we would say with the peace-loving innkeeper in Silas Marner, "Ye are both right and both wrong; shake hands and be friends."

ARCHIBALD MACLAREN

THE MAMMALIAN SKULL

Zur Morphologie des Säugethier-Schädels, von Joh. Chr. Gustav Lucae. With three lithographic plates and eight woodcuts. (Frankfort, 1872.)

THIS contribution to the anatomy of the Mammalian skull treats chiefly of the comparative proportions of those of Carnivora and Ruminants. After quoting Prof. Huxley's dictum on the importance of making longitudinal sections of every skull in an ethnological museum, the author justly insists upon its applicability to comparative osteology; and begins by a discussion on the true cranio-facial axis. He reviews the definitions adopted by other writers, and describes it as extending from the anterior margin of the *F. magnum* to the *F. cœcum*, thus including the basi-occipital, basi-sphenoid, pre-sphenoid, and cribriform plate of the ethmoid bone. He regards it not as a mere imaginary line drawn through the centres of these links in the chain, but as the actual solid elongated mass which they form when the surrounding parts are removed. Hence he speaks of the upper surface of the cranio facial axis, or, as he prefers to call it, the base of the skull, turned towards the brain, and its lower surface turned towards the pharynx and face.

The discrepancies between the different anatomists who have written on this subject have been chiefly due to the different objects for which the structure of the skull has been studied. To the morphologist, guided by a knowledge of embryology and comparative anatomy, it appears monstrous to include the diameter of a foramen as part of the base of the skull, formed of a series of bones which agree in their relations and partly in their development with the centra of the vertebræ. On the other hand the descriptive zoologist, and especially the ethnologist, to whom "transcendental anatomy" is apt to appear harsh and crabbed, asks fairly enough that he may be allowed to fix upon such a base-line as shall give him the most useful and convenient method of comparing the shape of different skulls. And if the practical physician tries as well as he can to ascertain the dimensions of the cranium during life, he is obliged to content himself with the best base-line he can get, which is probably that from the root of the nose to the most hollow part below the occipital protuberance.*

Prof. Lucae's object is a morphological comparison between the skulls of man and certain other mammals, and for this purpose we think his cranial basis is well chosen. It agrees with the "cranio-facial axis" adopted by Prof. Flower in his "Osteology of the Mammalia" (pp. 104, 105), in the chief point in which it differs from Huxley's "basi-cranial axis" (Journal of Anat. and Phys., Nov. 1866, p. 67, and "Anatomy of Vertebrated Animals," p. 23), namely, by the inclusion of the mesethmoid bone. And it differs from Prof. Cleland's "base-line" (Phil. Trans., 1869, p. 122), by the exclusion of the foramen magnum, as well as in being an actual mass of bones instead of a line drawn for purposes of measurement.

The most important question is, whether the line of bones which continues the centre of the vertebræ forward should be considered to stop with the pre-sphenoid or no. Having passed the basi-sphenoid, with which the notochord ends, and admitted the pre-sphenoid into the cranial axis, there seems no good reason from the development, the structure, or the relations of the bones, for not including in the series the next in order. And this must be the mesethmoid: for the claims of the vomer to be considered the centrum of a nasal vertebra may be put aside, because unlike the rest of the axis it is developed from membrane, because it takes no part in supporting the cerebrospinal axis, and because it is not articulated with the frontals or even with the anterior end of the pre-sphenoid.

Having defined the cranial basis, Prof. Lucae proceeds to compare the inclination of its four segments to each other and to a right line joining its two ends. This line, which in man of course will fall *below* the base of the skull, falls *above* it in Carnivora, and more or less completely *in* it in Ungulata. The differences chiefly depend on the greater or less inclination of the brain to the medulla oblongata, and the more or less horizontal position of the face and hence of the olfactory nerves. Careful measurements are given of the dimensions of the segments of the cranial axis and of the angles they make with each other in six Carnivora and eight Ungulata.

Next follows a comparison between the vault of the cranium and the facial bones in the wolf and antelope (*Redunca ellipsiprymna*). The compact osseous structure of the former is contrasted with the more spongy character of the latter; and it is shown how the position of the centre of gravity is altered by the great canine teeth of the carnivora and the horns of ruminants. A short section follows on the changes brought by age; and then come measurements of the cranial angles in various marine Carnivora, in Rodents, in the pig, barbirussa, and *Hyrax*. The last section treats of the skulls of monkeys and of man. Here the cranial axis, which in the seals is somewhat concave above, in otters almost flat, and gradually more bent in Carnivora and in Ruminants, has become strongly convex above, so as to make the cribriform plate and the foramen magnum horizontal instead of vertical, while the length of the vault of the skull in comparison with its base (as above defined) has enormously increased. The remarkable twisting down of the face under the cranium in some Ruminants (for it is little marked in the deer tribe), which is here noticed, has been already well described by Prof. Flower in the work above quoted. It is a remarkable character, but certainly

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* See an interesting paper by Dr. Gee in the St. Bartholomew Hospital Reports for last year.